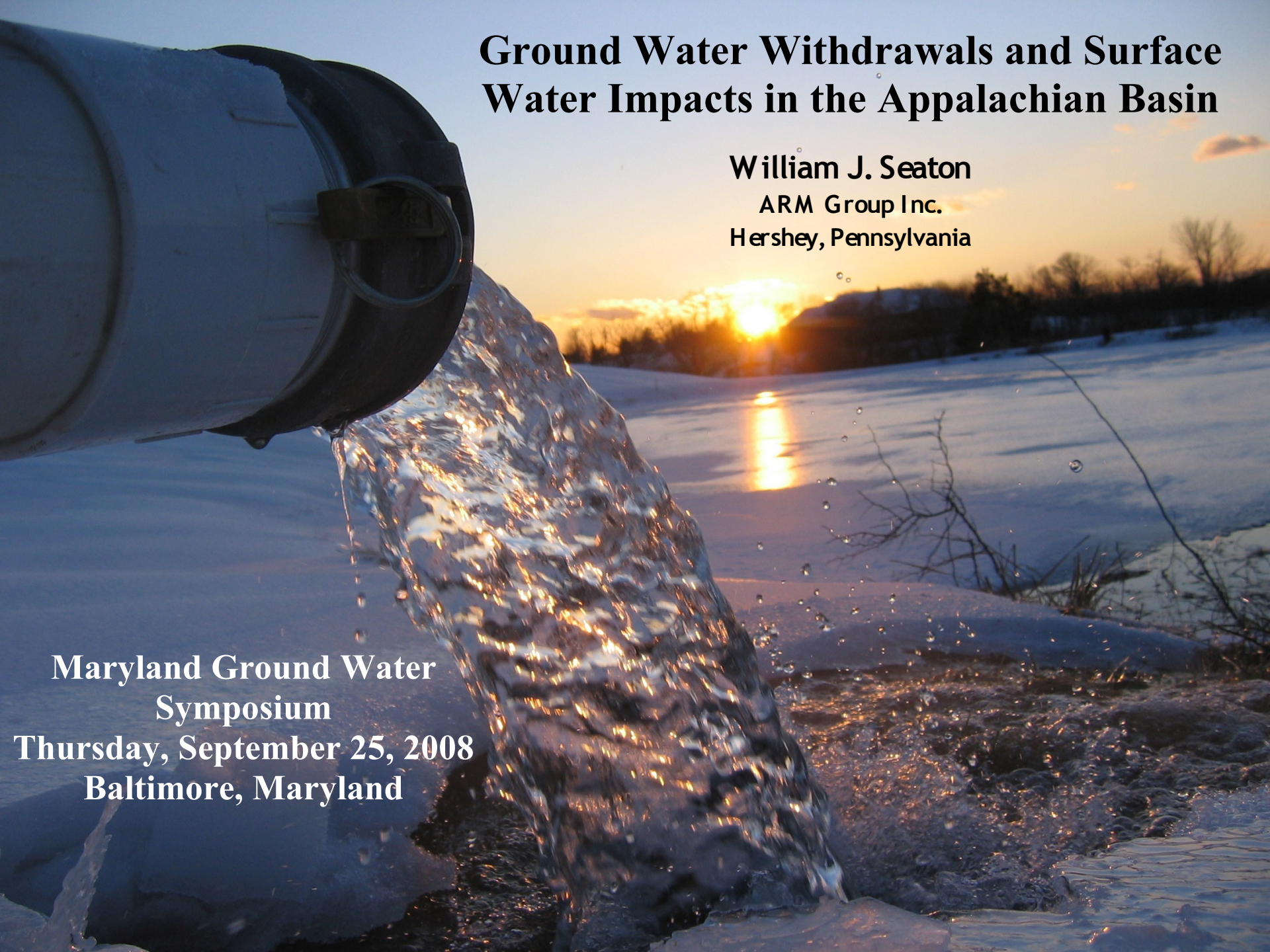

Ground Water Withdrawals and Surface Water Impacts in the Appalachian Basin

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Maryland Ground Water Symposium
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Baltimore, Maryland

GROUNDWATER WITHDRAWALS AND SURFACE WATER IMPACTS

Why is this an issue?

- High capacity water supply wells may draw water from nearby surface water bodies
  - Potential negative impacts
    - Lakes and ponds may experience a decline in water level
    - Flow in streams and rivers may be reduced
    - Diminished size of surface water feature causing loss of resources and property values
    - Decrease in flow for downstream water users
    - Faunas and floras degraded

Examples of Areas with Surface Water Degradation Due to Excessive Groundwater Withdrawals or Stream Diversions

- High Plains Aquifer
- Aral Sea
- Rio Grande River
- Colorado River
- Yellow River

Aral Sea - once a thriving fishery, now highly saline and diminished

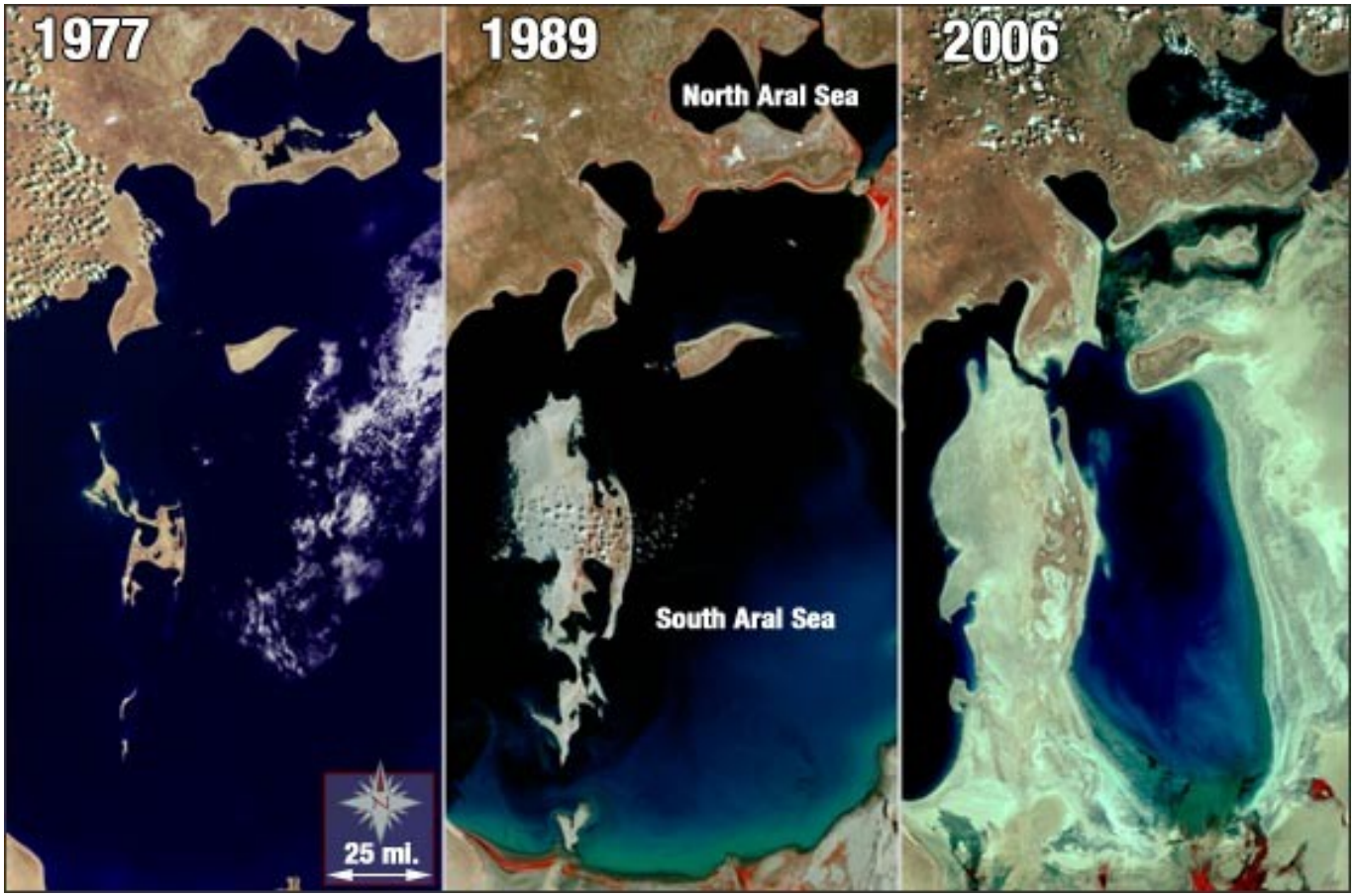
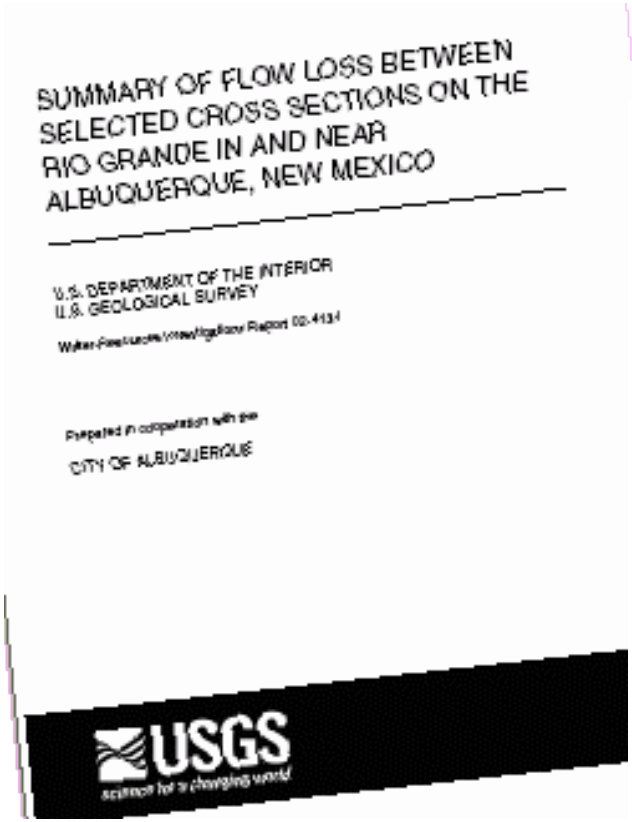


Photo credit: U.S. National Aeronautics and Space Administration-Goddard Space Flight Center

The Rio Grande has experienced significant flow loss due to excessive groundwater withdrawals and diversions



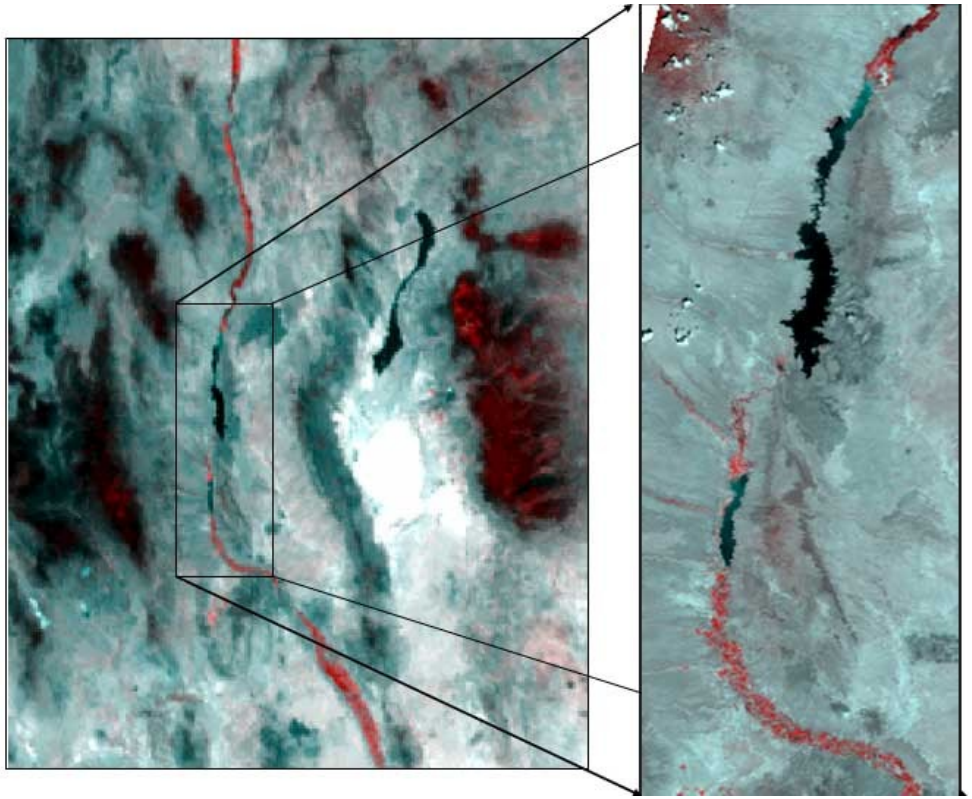
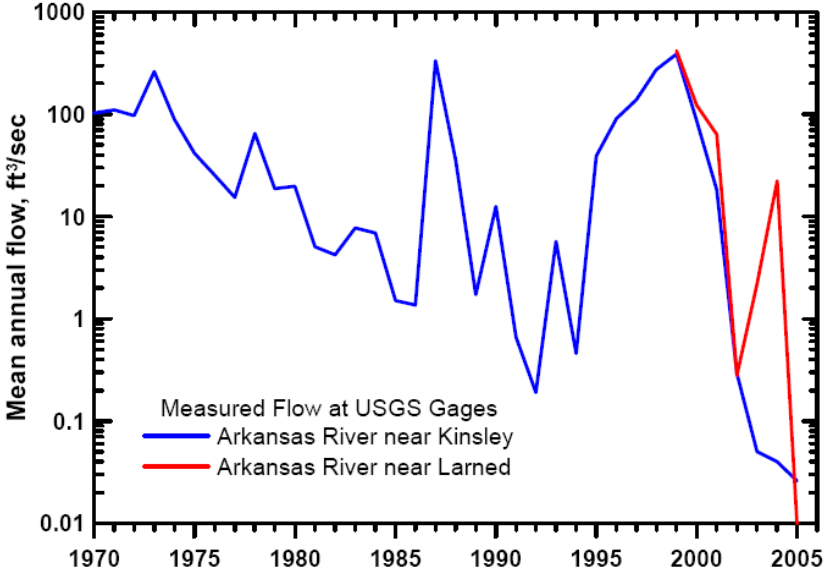
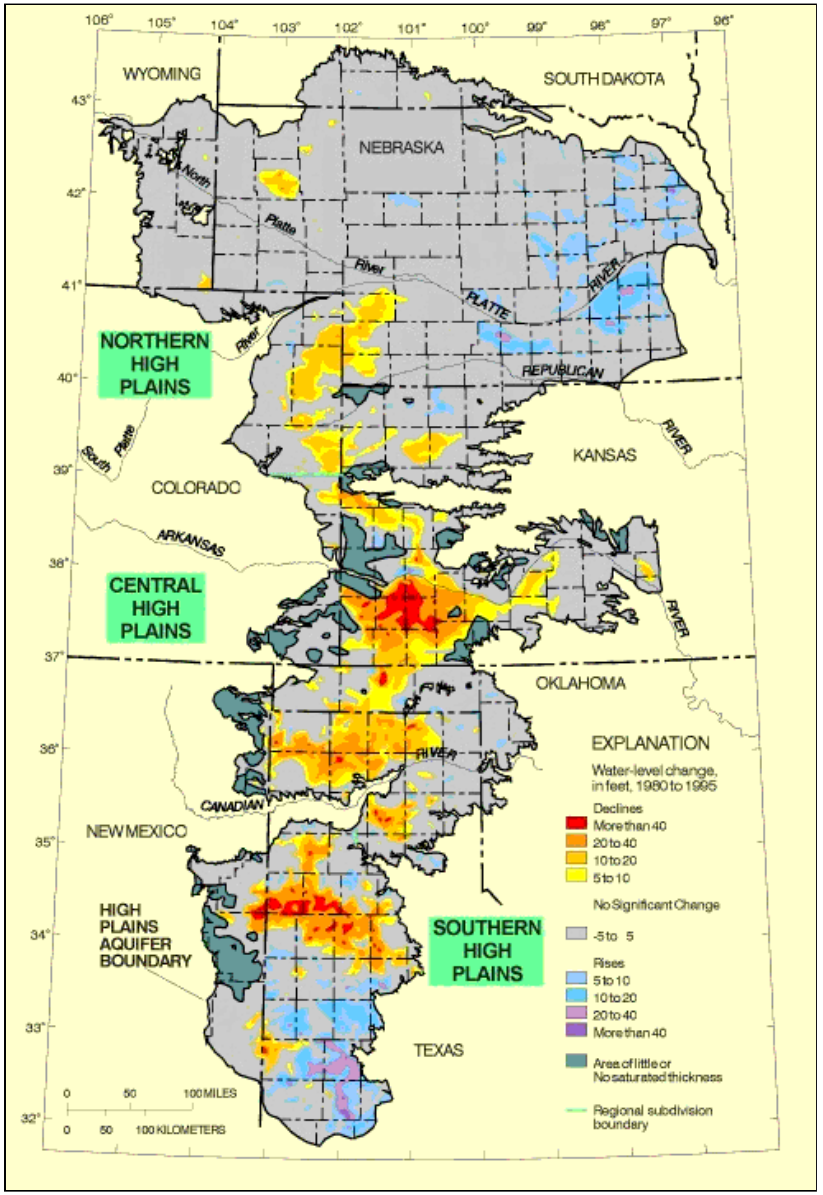


Photo credit: U.S. National Aeronautics and Space Administration-Goddard Space Flight Center

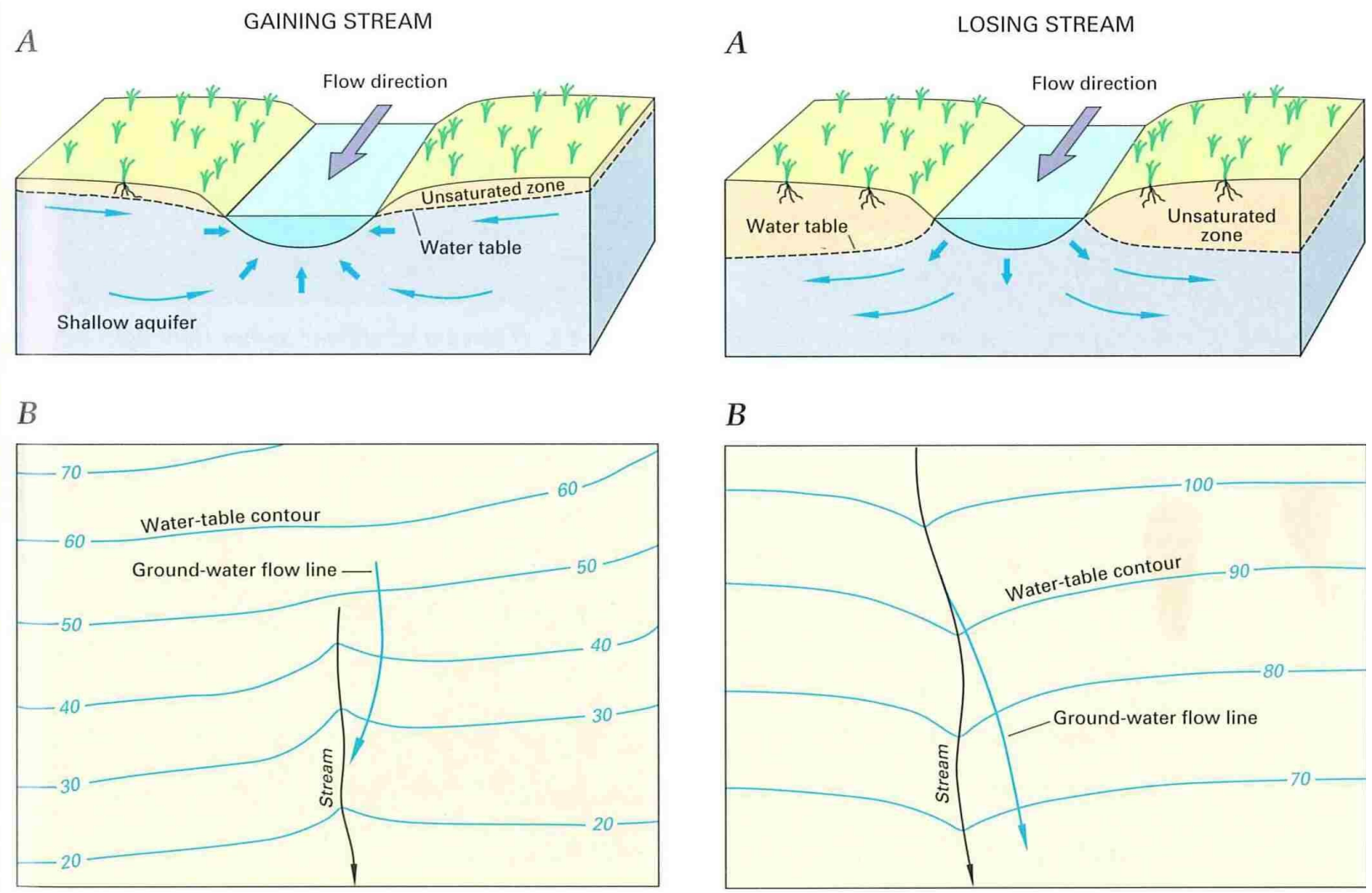
High Plains Aquifer Water Level Decline





Data Source: Ground-Water Model and Pumping Scenarios for the Middle Arkansas River Subbasin
Donald Whittemore, Kansas Geological Survey, University of Kansas

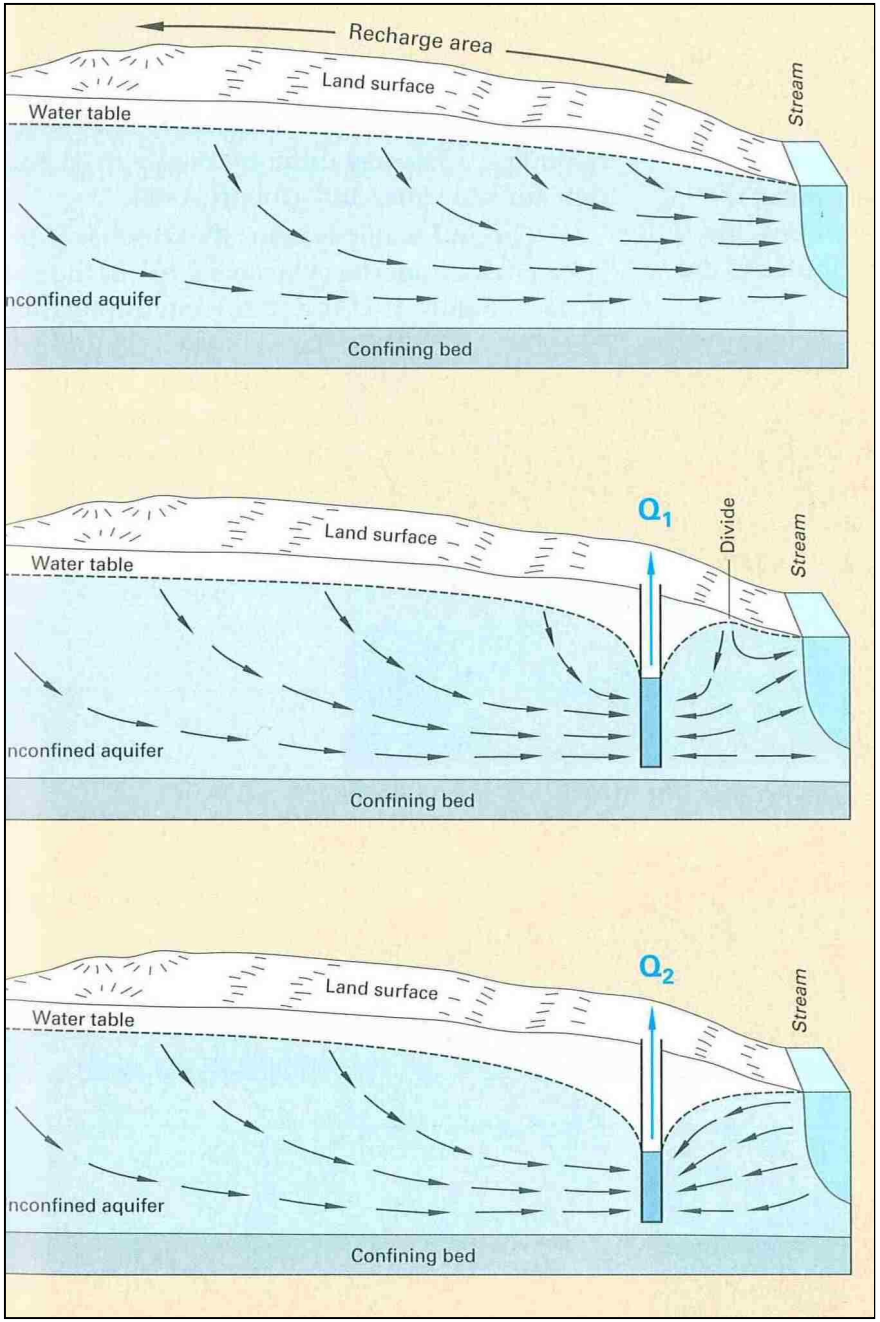
Gaining and Losing Streams



Source: USGS Ground Water and Surface Water: A Single Resource, Circular 1139

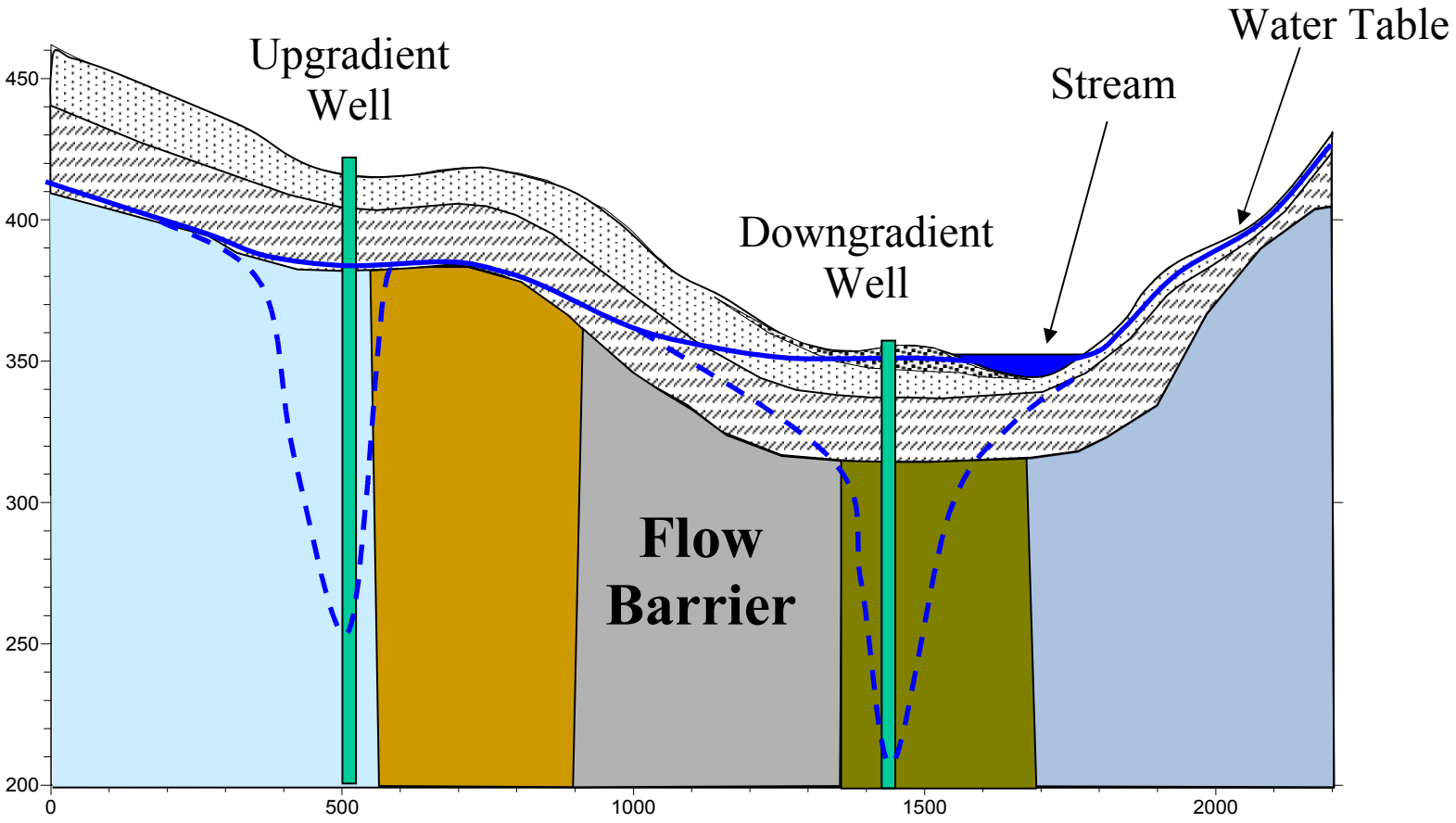
Groundwater Withdrawal and Stream Interaction

Isotropic-Homogeneous Aquifer



Source: USGS Ground Water and Surface Water: A Single Resource, Circular 1139

Complex Bedrock Geology Causing Anisotropic Flow



Existing Regulatory Limits for Withdrawals

- Linear limits set on pumping based upon streamflow:
  - Average Flow
  - Q 7-10 Flow

Q 7-10 Flow - statistical estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years.

(usually an indicator of low flow conditions during drought)

Existing Regulatory Limits for Withdrawals

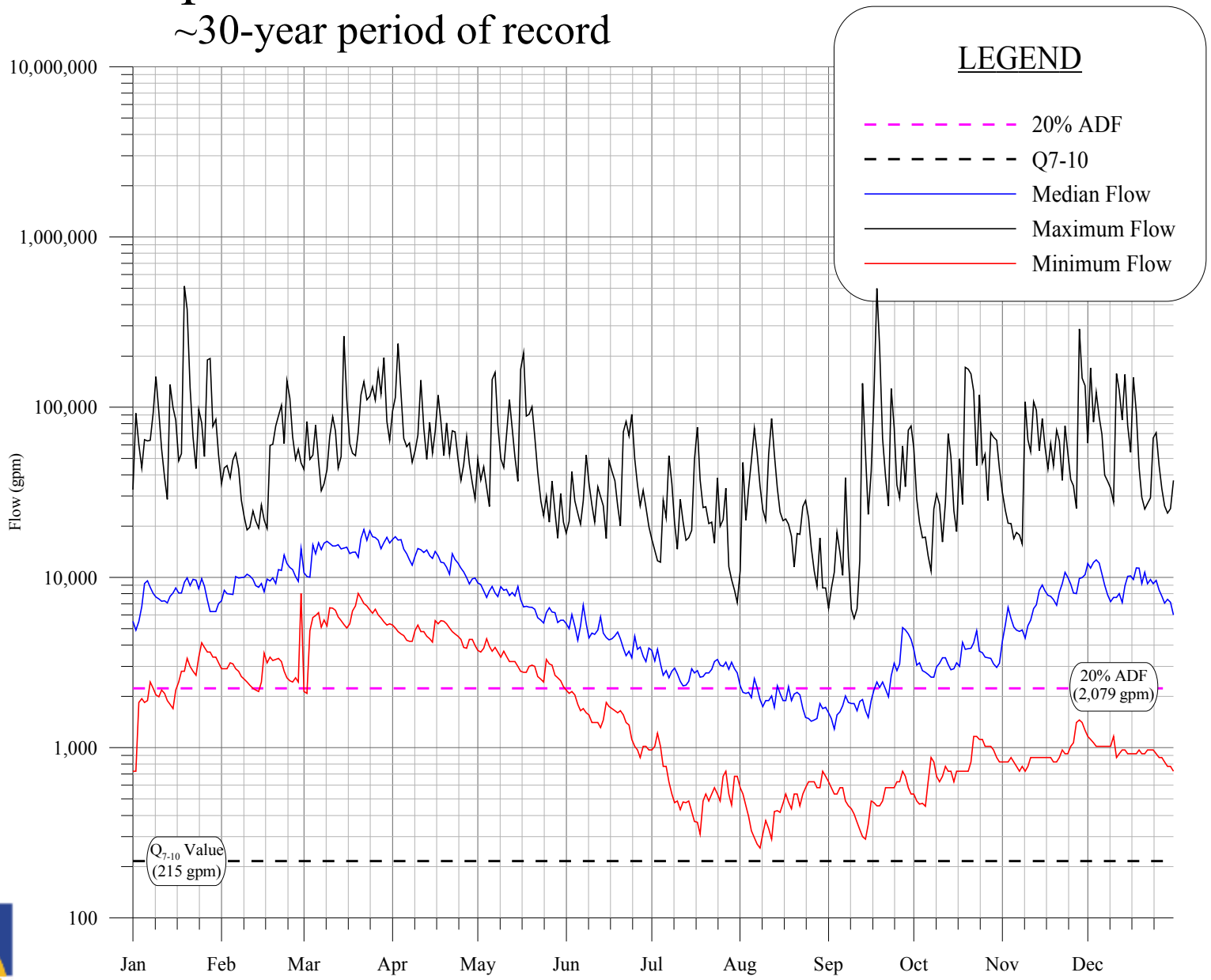
1) Require relatively precise measurement of streamflow (weir, flume or other type of installation)

3) Cease water withdrawals when streamflow falls below regulated limits

5) Withdrawals during normal seasonal low flow conditions (summertime) may be significantly curtailed or eliminated

Example Streamflow Values

~30-year period of record



Streamflow Measurement
Temporary Flume

Streamflow Measurement
Permanent V-notch weir

Streamflow Measurement
Permanent Rectangular Notch Weir

Is there a better way to regulate surface water use?

- Protect and maintain surface water resources
- Fair use of groundwater and surface water
- Maintain land owner rights
- Keep costs low and regulations simple

Is there a better way to regulate surface water use? (continued)

- Sub-basin view of water resources
  - Recharge Rates
  - Total Withdrawals
  - Impacts of Climate Change and Precipitation Variability on Recharge Rates
  - Stream Level Measurement
  - Allow exceptions to computed recharge rates based upon site specific pumping tests

    (particularly in anisotropic bedrock environments)

Stream Level Measurement

- Stream water level (stage) only - avoid weirs, flumes or complex stream gages
- Stream bank piezometers or stilling wells
- Strategic locations along watercourse

Stream Level Measurement (continued)

- Correlate with seasonal/annual changes in precipitation
- Determine impacts by comparing stream level measurements before and after pumping events
- Evaluate long term impacts of seasonal and year-round pumping on historic stream levels and precipitation

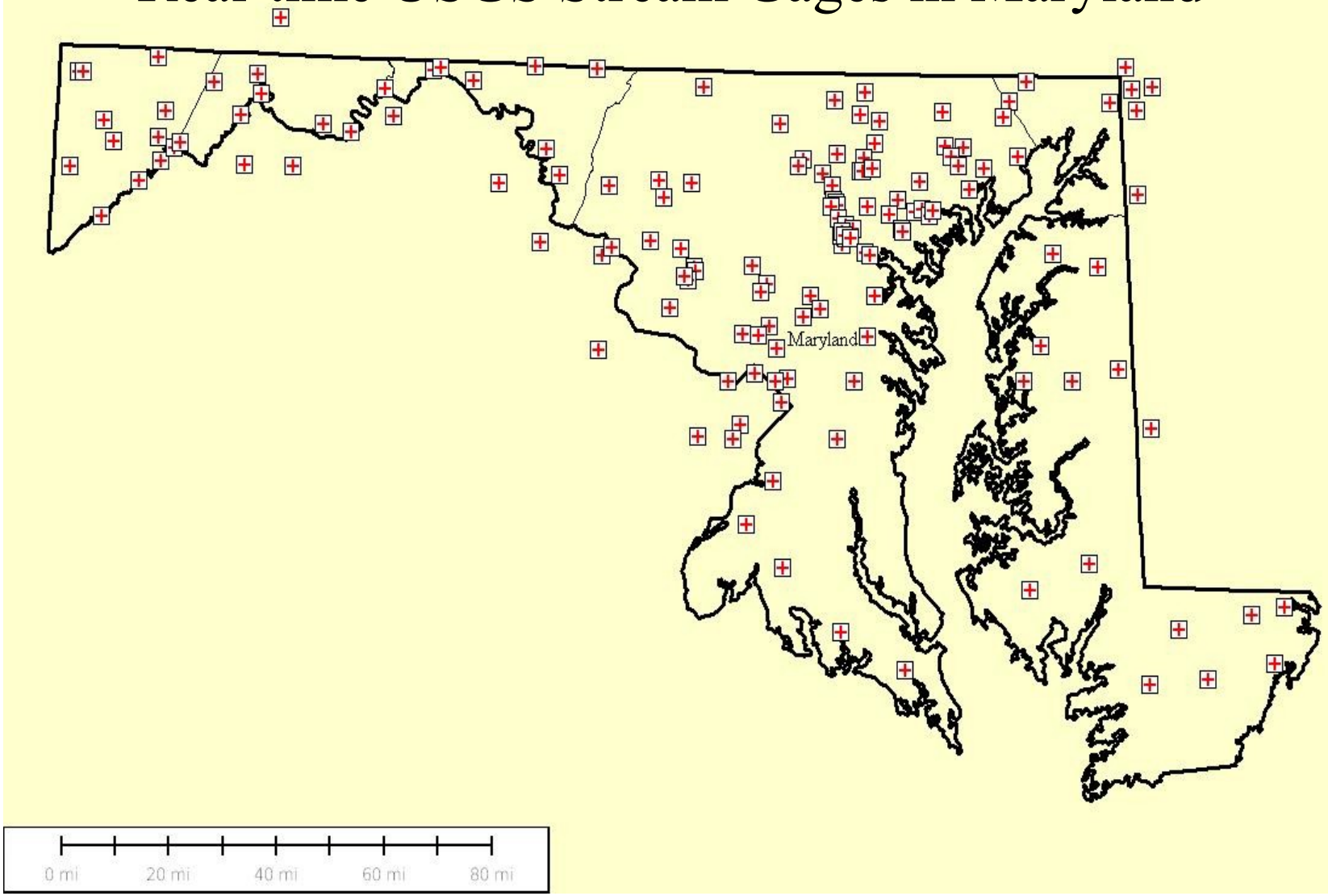
Monitoring stream level will provide:

- Reasonable estimates of stream flow
- Maintain resource viability and appearance
- Preserve aquatic habitats
- Fair use of water resources based upon natural and man-made water level fluctuations

Moving Forward

- Document sub-basin hydrogeology and ecology
- Support regulatory guidance with documented research and proven methodologies
- Additional USGS Gaging Stations
- Continue funding existing gages
  - NOTE!! Data collection for 9 USGS gages that measure flows in Maryland will be discontinued on September 30, 2008 due to funding reductions from partner agencies.

Real-time USGS Stream Gages in Maryland




Thank you for attending!
2008 Maryland
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